

**ADHEMARIUS DONYSA (DRUCE): IDENTIFICATION AND NOTES ON
CLOSELY RELATED SPECIES (LEPIDOPTERA: SPHINGIDAE)**

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Abstract.—Four closely related species of *Adhemarius*, occurring in southern Texas, Mexico, and Central America, have been cited as “*donyisa*” in the literature. Using distinguishing characters and accompanying illustrations, we clarify this confusion.

Key Words: *Adhemarius dariensis*, *A. blanchardorum*, *A. globifer*, male genitalia

Adhemarius Oiticica, 1939, was shown by Fletcher and Nye (1982: 4, 10) to be the valid generic name for a group of species formerly placed in *Amplifyterus* Hübner, 1819. *Adhemarius* is a New World genus of which six species occur in North and Central America: *Adhemarius blanchardorum* (Hodges), *A. dariensis* (Rothschild and Jordan), *A. donyisa* (Druce), *A. gannascus* (Stoll, in Cramer), *A. globifer* (Dyar), and *A. ypsilon* (Rothschild and Jordan). *Adhemarius gannascus* and *ypsilon* are widely distributed in the Neotropics, easy to separate from the other four, and will not further be considered in this paper. The most recent treatment of *Adhemarius* (D'Abrera 1987) ignores *blanchardorum*, synonymizes *globifer* with *donyisa* (with a question mark), and lists *dariensis* as valid, while conjecturing that it is a junior synonym of *donyisa*.

TAXONOMIC TREATMENT

Adhemarius donyisa (Druce)
(Figs. 1, 2, 15, 16)

Ambulyx donyisa Druce 1889: 78.

Adhemarius donyisa (Figs. 1, 2) appears to be restricted to a relatively small area on the Atlantic slope of central Mexico, com-

prising parts of the states of Hidalgo, Veracruz, and Oaxaca. Of the few specimens in collections, those with precise data have been collected at high elevations (1800 m and above).

Adhemarius donyisa was described by Druce, apparently from a single male specimen collected at Cuesta de Misantla, Mexico by M. Trujillo. This specimen is in The Natural History Museum, London (subsequently referred to as BMNH), and was illustrated by D'Abrera (1987: [53]) as *A. donyisa*. He inadvertently designated a lectotype (1987: 52) when he cited this syntype as the “holotype.” It bears the following labels: 1) a round printed label with a purple circular margin: “Lecto-/type”; 2) a rectangular printed label: “Cuesta de/Misantla/Mexico./M. Trujillo”; 3) a rectangular handwritten label: “*Ambulyx/donyisa*/Type Druce”; 4) a rectangular label with a black border at the top margin, two printed lines: “B.C.A. Lep. Het./*Ambulyx*” and two handwritten lines: “*donyisa*/Druce”; 5) a rectangular printed label: “Presented by/J.J.Joicey Esq./Brit. Mus. 1931-444”; a rectangular printed label: “figured by Bernard/D'Abrera, 1986, in/*Sphingidae* *Mundi*.”

In the original description, Druce (1889) stated that this new species would be illustrated in a forthcoming part of the *Biologia Centrali-Americana*. However, the specimen he later chose to illustrate in that work (1896: 3, pl. 66, fig. 7) belongs to another species, *A. dariensis*. Druce's misidentification of his own species has contributed considerably to the confusion in this group. In particular, Rothschild and Jordan (1903) followed Druce's later, incorrect treatment, and subsequent authors have done the same.

When Druce discussed *donyisa* in the *Biologia* (1896: 309–310), he cited specimens from Mexico: Cuesta de Misantla, Jalapa, and Orizaba; Guatemala: Guatemala City; and Panama: Chiriquí. About the specimen from Orizaba he writes: "... [it] is very much darker than any of the others before me, and on the underside it is reddish brown instead of yellow. It may belong to another species." This specimen is in the BMNH and is *donyisa*. Thus, Druce had conjectured that two taxa were involved but failed to recognize that he had already described the "other species."

A few years ago, one of us (JMC), while visiting the BMNH, noted the incorrect placement of two taxa under *donyisa* and made notes to that effect on the drawer's glass top. These notes apparently caused D'Abrera (1987: 52) to treat *dariensis* as a separate species from *donyisa*, without recognizing that this was a new status for *dariensis*, previously considered to be a subspecies of *donyisa*. Bridges (1993) follows this treatment. However, D'Abrera apparently does not believe his own action because he writes about *dariensis*: "This taxon is probably a junior synonym of *A. donyisa* Druce."

The female of *donyisa* is illustrated and described here for the first time (Fig. 2). We have seen only one example. It is very similar to the male, only slightly larger. The median line on the forewing upper side is straighter than in the male, reaching the inner margin nearer the tornus. The forewing upper side is darker than in the male. The

dark pattern on the hindwing upper side is much reduced with respect to that in the male. This is consistent with the sexual dimorphism present in the other species of the complex.

Adhemarius dariensis (Rothschild and Jordan), **revised status**
(Figs. 3, 4, 11, 12)

Ambulyx donyisa: Druce 1896, 2: 309–310 (in part); 3: pl. 66, fig. 7.

Amplipterus donyisa: Rothschild and Jordan 1903: 185.

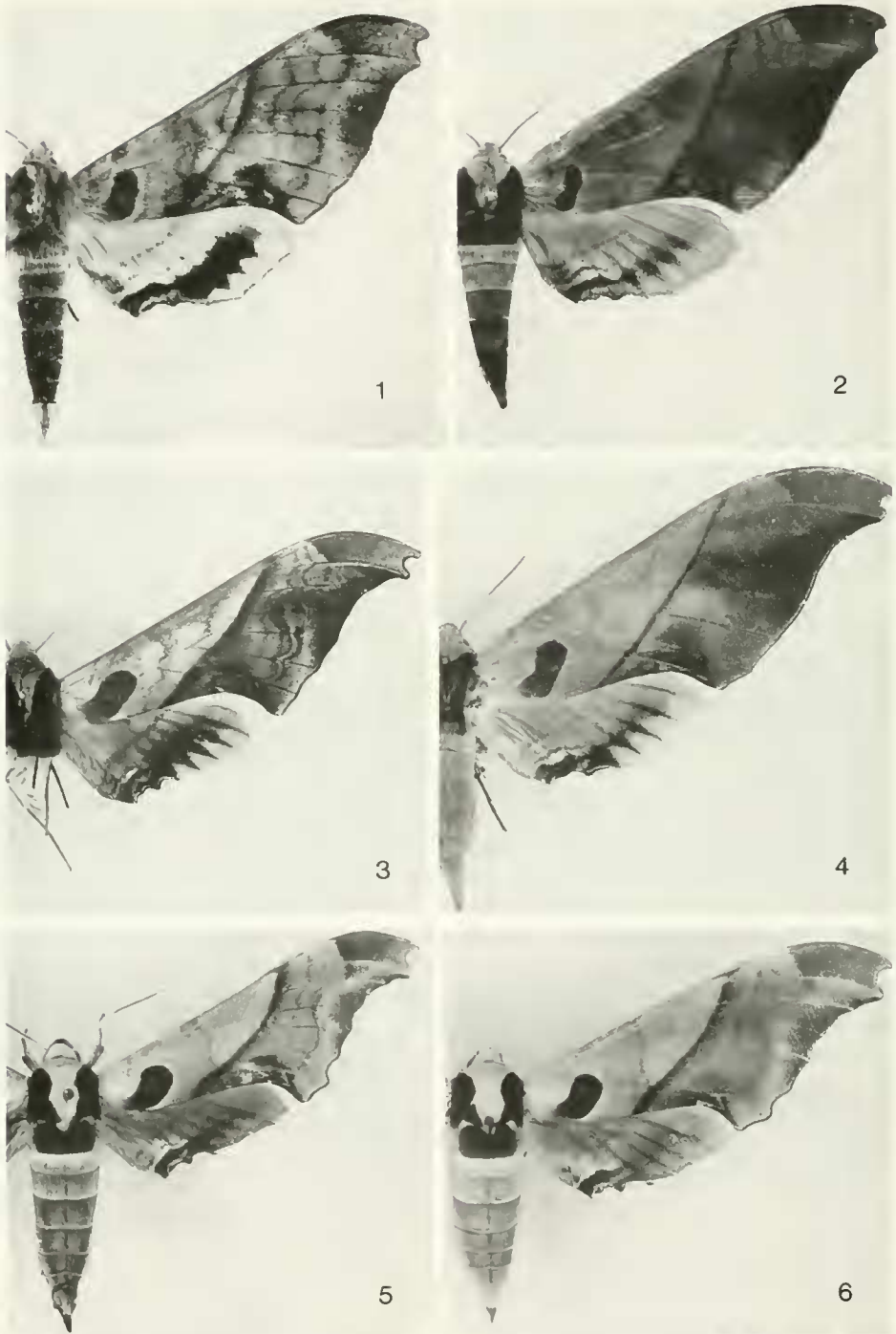
Amplipterus donyisa dariensis Rothschild and Jordan 1916: 253, 254.

Amplipterus donyisa: Hodges 1985: 323–328.

Adhemarius donyisa dariensis: Carcasson and Heppner, 1996: 51.

Adhemarius dariensis (Figs. 3, 4) is much more widespread than *donyisa*. Its known range, which includes that of *donyisa*, is from San Luis Potosí to Chiapas in Mexico and south through Central America to Panama (Chiriquí). The two species are sympatric although *dariensis* generally appears to occur at lower elevations than does *donyisa*. Specimens from Veracruz and farther north tend to have more elongate forewings, with a narrower apex, than do specimens from Chiapas and farther south and east. These and other differences led Rothschild and Jordan (1916) to separate the Costa Rican and Panamanian population from the Mexican population at their disposal, the latter of which they believed was referable to *donyisa*. Having examined a considerable number of specimens belonging to the entire geographic range and dissected specimens at the extreme ends of the pattern variation, we have not found clear characters to subdivide this taxon.

In their description of *dariensis*, Rothschild and Jordan mention they have four males, three from Costa Rica and one from Chiriquí, and indicate the type to be from Sitio, Costa Rica. D'Abrera (1987: 52) again inadvertently designated a lectotype



Figs. 1–6. Habitus of *Adhemarius* species. 1–2, *A. domysa*. 1, Male, Mexico, Hidalgo, Highway 130, 4 mi W Hidalgo/Puebla state line, La Cabaña, ca 2100 m, 4 July 1987; left forewing length (LFWL) = 53 mm. 2, Female, Mexico, Oaxaca, Sierra Juárez, Gulf Slope, ca 1800 m, 19 August 1991, at MIV light; LFWL = 55 mm. 3–4, *A. dariensis*. 3, Male, Mexico, Jalapa; LFWL = 51 mm. 4, Female, Mexico, Jalapa; LFWL = 58 mm. 5–6, *A. blanchardorum*. 5, Male, USA, Texas, Brewster County, Chisos Mts., Panther Pass, 1830 m, 4



Figs. 7-8. Habitus of *Adhemarius globifer*. 7, Male, Mexico, Mineras de Zacualpan [near Mexico City], August 1910, R. Müller; LFWL = 56 mm. 8, Female, Mexico, D. F. Zacualpan, leg. R. Müller [coll. CMNH]; LFWL = 59 mm.

when he cited a syntype as the "holotype." The lectotype of *dariensis* bears the following labels: 1) a round printed label with a purple circular margin: "Lecto-/type"; 2) a rectangular printed label: "Sitio/CR"; 3) a rectangular printed label: "June"; 4) a rectangular handwritten label: "*A. donysaldariensis*/Type. R & J./Nov. Zool. 1916"; 5) a rectangular printed label: "Rothschild/Bequest/B.M.1939-1". This specimen is illustrated in D'Abrera (1986: [53]) as *A. dariensis*. We recognize two paralectotypes: the other male in the BMNH from Sitio, Costa Rica, which bears the following labels: 1) a round printed label with a turquoise circular margin: "Para-/lecto-/type"; 2) a rectangular printed label: "Sitio; CR"; 3) a rectangular printed label: "June"; 4) a rectangular handwritten label: "*A. donysa*"; 5) a rectangular printed label: "Rothschild; Bequest; B.M.1939-1" and the male in the BMNH from Chiriquí, Vulkan (Trötsch) also with a Rothschild Bequest label. We cannot identify the fourth syntype with certainty. There are two males from Costa Rica

in the BMNH collection that were collected before 1916, one from Juan Vinas, 2500' (= 762 m) (W. Schaus) 1913-50, and one from Cachi, 30-xi-1910 (Lankester), either of which could have been the third Costa Rican male referred to in the original description.

Adhemarius globifer (Dyar), revised status

(Figs. 7, 8, 13, 14)

Amplipterus globifer Dyar 1912: 45.

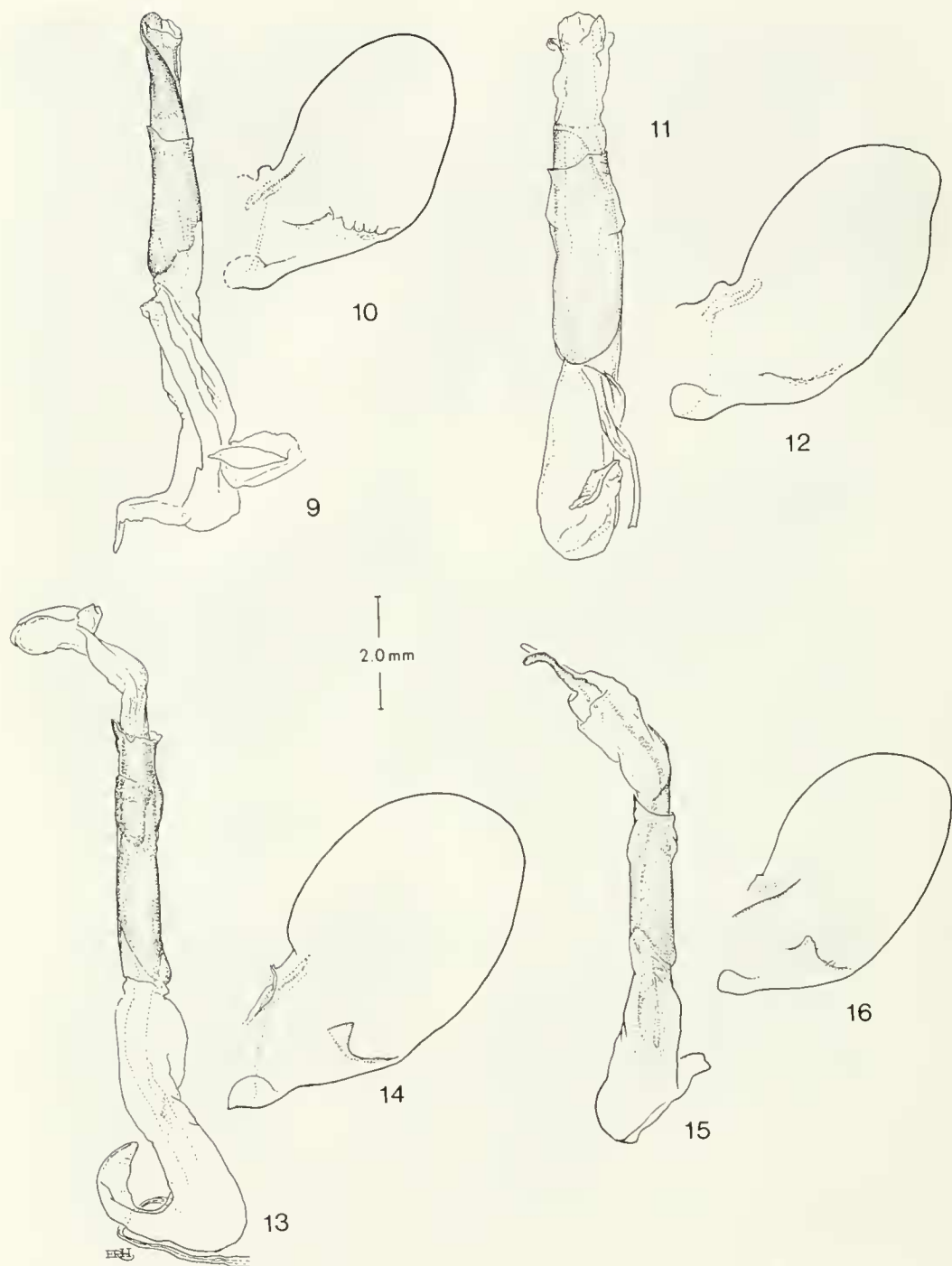
Adhemarius donysa: D'Abrera 1987: 52.

Adhemarius donysa: Bridges 1993: VIII.1.

Adhemarius globifer (Figs. 7, 8) appears to occur in Central Mexico (D.F.: Zacualpán, type locality), Morelos, Tamaulipas, Nuevo León, Chihuahua, and Sonora. Apparently a highland desert species, it does not seem to be sympatric with any of the other three species in the group. Few specimens are known, and our knowledge of its distribution is incomplete. Recent observations in Sonora indicate that the species oc-

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June 1973, R. W. Hodges; LFWL = 47 mm. 6, Female, USA, Texas, Big Bend National Park, Green Gulch, 6 May 1972, A. and M. E. Blanchard; LFWL = 53 mm.



Figs. 9-16. Male genitalia of *Adhemarius* species. 9-10, *A. blanchardorum*, USNM genitalia slide 12181. 9, Aedeagus. 10, Right valva. 11-12, *A. dariensis*, USNM genitalia slide 12183. 11, Aedeagus. 12, Right valva. 13-14, *A. globifer*, USNM genitalia slide 12185. 13, Aedeagus. 14, Right valva. 15-16, *A. donysa*, SAB genitalia slide 385. 15, Aedeagus. 16, Right valva.

curs in the oak zone at elevations between 1500 m and 2100 m.

The female was described by Clark (1923: 50). Contrary to the statement made by D'Abbrera (1987: 52), the female of *globifer* differs substantially from those of both *donyisa* and *dariensis*, in fact, more so than males do (cf. Figs. 3, 7 and the section on distinguishing characters), which confirms the validity of this taxon, rather than "... throwing further doubt on it." Furthermore, *globifer* is a paler species than either *donyisa* or *dariensis*, not darker.

Adhemarius blanchardorum (Hodges)
(Figs. 5, 6, 9, 10)

Amphlypterus donyisa: Blanchard 1973: 103.

Amphlypterus blanchardorum Hodges 1985: 323.

Adhemarius blanchardorum: Carcasson and Heppner 1996: 53.

Adhemarius blanchardorum (Figs. 5, 6) appears to be restricted to the Chisos Mountains in Texas, from which very few specimens are known.

DISTINGUISHING CHARACTERS

Males of *Adhemarius donyisa* can be separated from the other three species by the following characters: 1) broader wings, in particular forewing apex much less produced; and 2) median line of the forewing upper side much less oblique. A further feature separating *donyisa* from *dariensis* is the medial line on the hindwing underside: straight in *donyisa*, rather than curved basad when reaching the costal margin as it is in *dariensis*. *Adhemarius donyisa* shares with *dariensis* the following characters, which separate both of them from *globifer* and *blanchardorum*: 1) discocellular vein well outlined on both sides of the forewing; and 2) antemarginal black pattern on the hindwing upper side well marked and extending distad along the veins, almost reaching the posterior margin. *Adhemarius globifer* and *blanchardorum* can be separated by the shape of the dark submarginal area of the

forewing upper side. In *globifer* that area is globally convex with maximal width at M_2 and not sharply delimited basally, merging smoothly into the wing pattern. In *blanchardorum* that area is sharply delimited basally, generally narrower than in *globifer*, indented distally at M_2 and at M_3 , i.e. convex between the veins, and its maximal width occurs between M_1 and M_2 . In addition the ground color of the forewings is greener than the distinctly yellowish green of *globifer*.

The costal margin of the valva of *globifer* is straight at the base followed by a sharp angle, then broadly rounded to the apex (Fig. 14); the costal margin of *blanchardorum*, *dariensis*, and *donyisa* lacks the straight segment at the base and is not as broadly rounded to the apex. The sacculus fold is very poorly developed in *dariensis* (Fig. 12), well developed in the others. In *globifer* it is smooth margined and lacks setae except at the posterior part (Fig. 14), whereas in *donyisa* it has a well-developed extension at $\frac{1}{4}$ – $\frac{1}{5}$ its length, is nearly smooth, and has a few, short setae (Fig. 16). That of *blanchardorum* has an irregular margin with a few, short setae (Fig. 10). The apex of the aedeagus has a slender, curved extension in *blanchardorum*, *donyisa*, and *globifer* that is lacking in *dariensis*.

Females of *donyisa* can be separated from the other three species by the same external characters that separate the males. The female of *dariensis* can be separated from those of *globifer* and *blanchardorum* by the well-marked antemarginal black pattern on the hindwing upper side, extending distad along the veins. Also, the outer margin of the forewing in females of *globifer* and *blanchardorum* is crenulated near the tornus, which is not the case in *donyisa* or *dariensis*. The female of *blanchardorum* differs externally from that of *globifer* in the shape of the submarginal dark area of the forewing upper side in the same way as the male does and by the color as indicated above.

The female genitalia of *blanchardorum*

and *dariensis* have been illustrated (Hodges 1985: figs. 13–16). Those of *donyisa* and *globifer* have not.

ACKNOWLEDGMENTS

We thank J. W. Rawlins (Carnegie Museum of Natural History, Pittsburgh, PA, for providing us with an excellent photograph of the female *globifer*, Elaine R. S. Hodges for the line drawings, I. J. Kitching and M. Honey (The Natural History Museum, London) for their help and advice and for allowing full use of their institution's collection and facilities, and F. Rindge (American Museum of Natural History, NY), and J. Brown (University of California, Berkeley) for the loan of *Adhemarius* specimens.

LITERATURE CITED

- Blanchard, A. 1973. Record and illustration of some interesting moths flying in Texas (Sphingidae, Ctenuchidae, Noctuidae, Notodontidae, Geometridae, Pyralidae, Cossidae). *Journal of the Lepidopterists' Society* 27: 103–109.
- Bridges, C. A. 1993. Catalogue of the family-group, genus-group and species-group names of the Sphingidae of the world. C. A. Bridges, Urbana, Illinois. xxxiv + 252 pp.
- Carcasson, R. H. and J. B. Heppner. 1996. Sphingidae. *In* Heppner, J. B., ed., Atlas of Neotropical Lepidoptera 5B, Checklist (part 4B): i-1 + 1–87.
- Clark, B. P. 1923. Thirty-three new Sphingidae. *Proceedings of the New England Zoological Club* 8: 47–77.
- D'Abrera, B. [1987] 1986. Sphingidae Mundi-Hawk moths of the world. E. W. Classey, Faringdon, Oxon. x + 226 pp.
- Druce, H. 1889. Descriptions of new species of Lepidoptera, chiefly from Central America. *Annals and Magazine of Natural History (series 6) iv*: 77–94.
- . 1896. *Biologia Centrali-Americana. Lepidoptera Heterocera* 2: 309–310. 3: pl 66.
- Dyar, H. G. 1912. Descriptions of new species and genera of Lepidoptera, chiefly from Mexico. *Proceedings of the United States National Museum* 42(1885): 39–106.
- Fletcher, D. S. and I. W. B. Nye. 1982. Bombycoidea, Castnioidea, Cossioidea, Mimallonoidea, Sesioidea, Sphingoidea, Zygaenoidea. *In* Nye, I. W. B., ed., *The generic names of moths of the world*, 4. Trustees of the British Museum (Natural History), London. xiv + 192 pp.
- Hodges, R. W. 1985. A new species of *Amplifyterus* from the Chisos Mountains, Texas (Lepidoptera: Sphingidae). *Proceedings of the Entomological Society of Washington* 87(2): 323–328.
- Oiticica F. J. 1939. XII-Sphingidae. *Boletim Biológico (n.s.)* 4(2): 269–277.
- Rothschild, W. and K. Jordan. 1903. A revision of the lepidopterous family Sphingidae. *Novitates Zoologicae* 9 (supplement): cxxxv + 1–972.
- . 1916. Further corrections of and additions to our "Revision of the Sphingidae." *Novitates Zoologicae* 23: 247–263.